Mechanics Key Stage 5 Maths Curriculum

Autumn 1	
Applied Maths Chapter 8: Modelling in mechanics	Applied Maths Chapter 9: Constant acceleration
Assessment: Ch 8 Modelling in mechanics	Assessment: Ch 9 Constant acceleration
Builds Upon (GCSE (9-1) in Mathematics at Higher Tier): • Change freely between related standard units (e.g. time, length, area, volume/capacity, mass) and compound units (e.g. speed, rates of pay, prices, density, pressure) in numerical and algebraic contexts • Use compound units such as speed, rates of pay, unit pricing, density and pressure • Plot and interpret graphs (including reciprocal graphs and exponential graphs) and graphs of non-standard functions in real contexts to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration • Calculate or estimate gradients of graphs and area under graphs (including quadratic and non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial context	Builds Upon (GCSE (9-1) in Mathematics at Higher Tier): • Change freely between related standard units (e.g. time, length, area, volume/capacity, mass) and compound units (e.g. speed, rates of pay, prices, density, pressure) in numerical and algebraic contexts • Use compound units such as speed, rates of pay, unit pricing, density and pressure • Substitute numerical values into formulae and expressions, including scientific formulae • A5 Understand and use standard mathematical formulae; rearrange formulae to change the subject • Plot and interpret graphs (including reciprocal graphs and exponential graphs) and graphs of non-standard functions in real contexts to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration • Calculate or estimate gradients of graphs and area under graphs (including quadratic and non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts • Solve linear equations in one unknown algebraically (including those with the unknown on both sides of the equation) • Solve quadratic equations (including those that require rearrangement) algebraically by factorising, by completing the square and by using the quadratic formula

Introduces: • Understand the concept of a mathematical model, and be able to abstract from a real-world situation to a mathematical description (model); • know the language used to describe simplifying assumptions; • understand the particle model; • be familiar with the basic terminology for mechanics; • be familiar with commonly-made assumptions when using these models; • be able to analyse the model appropriately, and interpret and communicate the implications of the analysis in terms of the situation being modelled; • understand and use fundamental quantities and units in the S.I. system: length, time and mass; • Understand that units behave in the same way as algebraic quantities, e.g. meters per second is • $m/s = m \times 1/s = ms^{-1}$	Introduces: • Understand and interpret displacement-time graphs • Understand and interpret velocity-time graphs • Derive the constant acceleration formulae and use them to solve problems • Derive the constant acceleration formulae and use them to solve problems • Use the constant acceleration formulae to solve problems involving vertical motion under gravity

Autumn 2	
Applied Maths Chapter 9: Constant acceleration (Continuing…)	Applied Maths Chapter 10: Forces and Motion
Assessment: Ch 9 Constant acceleration	**Assessment:** Ch 10 Force and motion
Builds Upon (GCSE (9-1) in Mathematics at Higher Tier): • Change freely between related standard units (e.g. time, length, area, volume/capacity, mass) and compound units (e.g. speed, rates of pay, prices, density, pressure) in numerical and algebraic contexts • Use compound units such as speed, rates of pay, unit pricing, density and pressure • Substitute numerical values into formulae and expressions, including scientific formulae • A5 Understand and use standard mathematical formulae; rearrange formulae to change the subject • Plot and interpret graphs (including reciprocal graphs and exponential graphs) and graphs of non-standard functions in real contexts to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration • Calculate or estimate gradients of graphs and area under graphs (including quadratic and non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts • Solve linear equations in one unknown algebraically (including those with the unknown on both sides of the equation) • Solve quadratic equations (including those that require rearrangement) algebraically by factorising, by completing the square and by using the quadratic formula	**Builds Upon (GCSE (9-1) in Mathematics at Higher Tier):** • Solve two simultaneous equations in two variables (linear/linear or linear/quadratic) algebraically; find approximate solutions using a graph **Builds Upon (Year 1 Applied chapter 8):** • Modelling and definitions/assumptions from the introduction
Introduces: • Understand and interpret displacement-time graphs • Understand and interpret velocity-time graphs • Derive the constant acceleration formulae and use them to solve problems	**Introduces:** • Draw force diagrams and calculate resultant forces • Understand and use Newton's first law • Calculate resultant forces by adding vectors • Understand and use Newton's Second law F=ma • Apple Newton's second law to vector forces and acceleration

• Derive the constant acceleration formulae and use them to solve problems • Use the constant acceleration formulae to solve problems involving vertical motion under gravity	• Understand and use Newton's third law • Solve problems involving connected particles

Spring 1

Applied Maths Chapter 10: Forces and Motion (Continuing…)

Assessment: Ch 10 Force and motion

Builds Upon (GCSE (9-1) in Mathematics at Higher Tier):

- Solve two simultaneous equations in two variables (linear/linear or linear/quadratic) algebraically; find approximate solutions using a graph

Builds Upon (Year 1 Applied chapter 8):

- Modelling and definitions/assumptions from the introduction

Introduces:

- Introduces:
- Draw force diagrams and calculate resultant forces
- Understand and use Newton's first law
- Calculate resultant forces by adding vectors
- Understand and use Newton's Second law F=ma
- Apple Newton's second law to vector forces and acceleration
- Understand and use Newton's third law
- Solve problems involving connected particles

Spring 2

Applied Maths Chapter 11: Variable acceleration

Assessment: Ch 11 Variable Accelerations

Builds Upon (GCSE (9-1) in Mathematics at Higher Tier):

- Identify and interpret roots, intercepts, turning points of quadratic functions graphically; deduce roots algebraically and turning points by completing the square
- Plot and interpret graphs (including reciprocal graphs and exponential graphs) and graphs of non-standard functions in real contexts to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration
- Calculate or estimate gradients of graphs and area under graphs (including quadratic and non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts

Introduces:

- Understand that displacement, velocity and acceleration may be given as functions of time

- Use differentiation to solve kinematics problems
- Use calculus to solve problems involving maxima and minima
- Use integration to solve kinematics problems
- Use calculus to derive constant acceleration formulae